SOMAIYA VIDYAVIHAR UNIVERSITY

Semester: June – Sep 24 **Maximum Marks: 50 Examination: ETE Exam Date: 6/11/2024 Duration: 2 Hours**		
Programme code: 1 **Programme: MBA**	**Class:** FY	**Semester/Trimester: I**
College: K. J. Somaiya Institute of Management	**Name of the department/Section/Center: Business Analytics**	
Course Code: 317P01C103	**Name of the Course: Decision Science**	

Instructions:

1. **All questions are compulsory. There is an internal choice in Que 1B and in Que 3.**
2. **Make suitable assumptions if required and state them.**
3. **Write all relevant answers and interpretations in your Excel sheet, with sufficient details in an easily readable manner to enable a fast evaluation of your answers.**
4. **Keep saving the file every ten minutes or so.**
5. **Make only 1 Excel file with different worksheets pertaining to each question.**
6. **The naming convention for the file should have your roll number and name.**
7. **Please follow the instructions of the faculty/IT staff on duty.**

Question No.		**Max. Marks**
1A	The following table reports the percentage of stocks in a typical portfolio in nine quarters from 2005 to 2007.	10

Quarter	Stock (%)	Quarter	Stock (%)
1st ---2005	29.8	2nd ---2006	31.5
2nd ---2005	31.0	3rd ---2006	32.0
3rd ---2005	29.9	4th ---2006	31.9
4th ---2005	30.1	1st ---2007	30.0
1st ---2006	32.2		

a) Use exponential smoothing to forecast this time series. Consider smoothing constants of α = 0.3, 0.5, and 0.7. What value of the smoothing constant provides the best forecast?

b) What is the forecast of the percentage of assets committed to stocks for the second quarter of 2007 using the best forecast identified in part (a) above?

1B	A manufacturing firm produces diesel engines in four cities Phoenix, Seattle, St. Louis, and Detroit. The company is able to produce the following numbers of engines per month: **Plant** **Production** Phoenix 5 Seattle 25 St. Louis 20 Detroit 25 Three trucking firms purchase the following numbers of engines for their plants in three cities: **Firm** **Demand** Greensboro 10 Charlotte 20 Louisville 15 The transportation costs per engine (in hundreds of dollars) from sources to destinations are shown in the following table. However, the Charlotte firm will not accept engines made in Seattle, and the Louisville firm will not accept engines from Detroit; therefore, those routes are prohibited: Solve the problem to determine the minimum shipping cost. **OR** The Bunker Manufacturing firm has five employees and six machines and wants to assign the employees to the machines to minimize cost. A cost table showing the cost incurred by each employee on each machine follows: Because of union rules regarding departmental transfers, employee 3 cannot be assigned to machine E, and employee 4 cannot be assigned to machine B. Solve this problem, indicate the optimal assignment, and compute total minimum cost.	5
2	A grocery store orders milk from a diary on weekly basis. The manager of the store has developed the following probability distribution for demand per week: **Demand (cases)** **Probability** 15 .20 16 .25 17 .40 18 .15	15

	Firm		
	Greensboro	Charlotte	Louisville
Plant Phoenix	7	8	5
Plant Seattle	6	-	6
Plant St. Louis	10	4	5
Plant Detroit	3	9	-

	Machine					
Employees	**A**	**B**	**C**	**D**	**E**	**F**
1	12	7	20	14	8	10
2	10	14	13	20	9	11
3	5	3	6	9	7	10
4	9	11	7	16	9	10
5	10	6	14	8	10	12

The milk costs the grocery $10 per case and sells for $16 per case. The carrying cost is $ 0.05 case per week, and the shortage cost is $ 1 per case per week.

a. Simulate the ordering system for the grocery store for 20 weeks.

b. Determine the total shortage cost.

c. Determine the service level. (Hint: Ratio of Total Sales/Total Demand)

3 — 20

The Battery Park Stable feeds and houses the horses used to pull tourist-filled carriages through the streets of Charleston's historic waterfront area. The stable owner, an ex-racehorse trainer, recognizes the need to set a nutritional diet for the horses in his care. At the same time, he would like to keep the overall daily cost of feed to a minimum.

The feed mixes available for the horses' diet are an oat product, a highly enriched grain, and a mineral product. Each of these mixes contains a certain amount of five ingredients needed daily to keep the average horse healthy. The table below shows these minimum requirements, units of each ingredient per pound of feed mix, and costs for the three mixes.

	FEED MIX			
DIET REQUIREMENT (INGREDIENTS)	**OAT PRODUCT (UNITS/LB)**	**ENRICHED GRAIN (UNITS/LB)**	**MINERAL PRODUCT (UNITS/LB)**	**MINIMUM DAILY REQUIREMENT (UNITS)**
A	2	3	1	6
B	0.5	1	0.5	2
C	3	5	6	9
D	1	1.5	2	8
E	0.5	0.5	1.5	5
Cost/lb	$0.09	$0.14	$0.17	

In addition, the stable owner is aware that an overfed horse is a sluggish worker. Consequently, he determines that a total of 6 pounds of feed per day is the most that any horse needs to function properly.

a. Formulate this problem and solve for the optimal daily mix of the three feeds.

b. Interpret the non-binding constraints

OR

National Insurance Associates carries an investment portfolio of stocks, bonds, and other investment alternatives. Currently $200,000 of funds are available and must be considered for new investment opportunities. The four stock options National is considering and the relevant financial data are as follows:

	Stock			
	A	**B**	**C**	**D**
Price Per share	$ 100.00	$ 50.00	$ 80.00	$ 40.00
Annual rate of return per share	12	4	4.8	4
Risk per share	10	3.5	4	3.2

National's top management has stipulated the following investment guidelines: The annual rate of return for the portfolio must be at least 9% of the total investment and no one stock can account for more than 50% of the total dollar investment. The above information was used to formulate a linear programming problem to develop an investment portfolio that minimizes risk as given below.

Let A = number of shares of stock A; B = number of shares of stock B; C = number of shares of stock C; D = number of shares of stock D.

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\begin{array}{lrcrcrcrl}
\text{Min} & 10A & + & 3.5B & + & 4C & + & 3.2D & \\
\text{s.t.} & & & & & & & & \\
 & 100A & + & 50B & + & 80C & + & 40D & = \quad 200{,}000 \\
 & 12A & + & 4B & + & 4.8C & + & 4D & \geq \quad 18{,}000 \quad (9\% \text{ of } 200{,}00) \\
 & 100A & & & & & & & \leq \quad 100{,}000 \\
 & & & 50B & & & & & \leq \quad 100{,}000 \\
 & & & & & 80C & & & \leq \quad 100{,}000 \\
 & & & & & & & 40D & \leq \quad 100{,}000 \\
 & & & & & A,\ B,\ C,\ D \geq 0 & & &
\end{array}
$$

Solve the above using Solver and generate the sensitivity report to answer the following questions:

a. How many shares are allocated to each of the four variables? What is the total risk associated with this portfolio?

b. What are the objective coefficient ranges for the four variables? Interpret these ranges.

c. Suppose that the firm decides that the annual rate of return must be at least 10% (i.e. 20000). What would be the impact on the total risk because of this change ?

d. If the management insists on allocating some shares to stock B but does not want the overall risk to increase, what will your advise be to the management?

e. "If we reduce the maximum allowable dollar investment in Stock D by 20,000 , the overall risk will also reduce". Is the given statement correct? Explain.